

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE



In re application of:

David R. Hembree  
Alan G. Wood

Serial No.: 09/933,492

Art Unit: 2815

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For: SEMICONDUCTOR COMPONENT  
HAVING CONDUCTORS WITH  
DIGITAL DATA PATTERN  
(AS AMENDED)

Examiner: Chu, Chris

Attorney Docket No. 00-0625.1

**APPEAL BRIEF**

**February 2, 2006**

Mail Stop Appeal Brief - Patents  
Commissioner For Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

This Appeal Brief is being filed concurrently with a Notice of Appeal dated 02/02/2006. This Appeal Brief and the Notice of Appeal are in response to the rejections contained in the final Office Action mailed 11/03/2005, having a statutory period for response set to expire on 02/03/2006.

Also being submitted are the \$500 fee under 37 CFR 41.20(b)(2) for the Appeal Brief, and the \$500 fee under 37 CFR 41.20(b)(1) for the Notice of Appeal.

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**i. REAL PARTY IN INTEREST**

The real party in interest in the appeal is Micron Technology Inc., the assignee of record of the patent application.

**ii. RELATED APPEALS AND INTERFERENCES**

There are no other appeals or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in this appeal.

### **iii. STATUS OF CLAIMS**

Claims 1-51 (canceled).

Claims 52-62 (rejected).

Claims 63-60 (canceled).

Claims 70-77 (rejected).

Claims 52-62 and 70-77 are being appealed.

**iv. STATUS OF AMENDMENTS**

No amendments have been filed subsequent to the final Office Action mailed 11/03/2005.

## **v. SUMMARY OF CLAIMED SUBJECT MATTER**

The rejected claims are directed to a semiconductor component (un-numbered) which is shown in Figure 4. The component includes a substrate 10 (Figure 4, page 7, line 9) comprising a plurality of semiconductor components 12 (Figure 4, page 7, line 10). As described on page 7, lines 8-23 of the specification, the substrate 10 (Figure 4) can comprise a semiconductor wafer, and the semiconductor components 12 (Figure 4) can comprise semiconductor dice 54 (Figure 7B) or semiconductor packages 52 (Figure 7B).

Each semiconductor component 12 (Figure 4) includes a plurality of component contacts 28 (Figure 4, page 7, line 21), such as bond pads 58 (Figure 7B, page 16, line 21), and a plurality of integrated circuits 56 (Figure 7B, page 16, lines 20-22) in electrical communication with the component contacts 28 (Figure 4). In addition, the semiconductor components 12 (Figure 4) include a plurality of good components (same as semiconductor components 12-Figure 4), and at least one defective component 12D (Figure 4). The good components 12 and the defective component 12D are initially described on page 7, lines 24-30 of the specification.

Each component 12 (Figure 4) also includes a plurality of conductors 22 (Figure 2F, page 14, lines 10-13) configured to perform the dual function of redistributing the component contacts 28 (Figure 4) on the good components 12 (page 10, lines 22-30), and of either repairing, reconfiguring, or electrically isolating the defective components 12D (page 13, line 22 to page 14, line 9). In addition, the conductors 22 (Figure 2F) have a pattern containing digital data 36 (Figure 3) representing the

locations of the good components 12, the defective component 12D and the component contacts 28 (page 12, lines 8-15).



## **vi. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

1. Whether the drawings show the feature of "the conductors having a pattern containing digital data representing locations of the good components, the defective component and the component contacts".

2. Whether the limitation in the claims of "the conductors having a pattern containing digital data representing locations of the good components, the defective component and the component contacts" represents new matter introduced into the disclosure.

3. Whether claims 52, 56, 60 and 70 fail to satisfy the written description requirement of 35 USC §112, second paragraph because the limitation "the conductors having a pattern containing digital data representing locations of the good components, the defective component and the component contacts" is not supported by the specification.

4. Whether claims 52, 56, 60 and 70 are indefinite under 35 USC §112, second paragraph, due to the limitations of

(a) "a plurality of conductors... in electrical communication with the component contacts configured to redistribute the component contacts on the good components";

(b) "and to repair the defective component by connecting selected component contacts on the defective component with selected integrated circuits on the defective component"; and

(c) "the conductors having a pattern containing digital data representing locations of the good components, the defective component and the component contacts".

5. Whether claims 52-62 and 70-77 are anticipated under 35 USC §102(e) by Hsuan et al. (US Patent No. 6,214,620 B1).

## **vii. ARGUMENT**

### **1. Objection to the drawings**

The objection to the drawings is based on the recitation in the claims of "the conductors having a pattern containing digital data representing locations of the good components, the defective component and the component contacts". However, all of the features in this recitation are shown in the drawings.

The conductors 22 are shown in Figure 2F.

The digital data 36 is shown in Figure 3.

The good components 12 are shown in Figure 4.

The defective component 12D is shown in Figure 4.

The component contacts 28 are shown in Figure 4.

Accordingly, the objection to the drawings is submitted to be in error.

### **2. Objection to new matter introduced into the disclosure**

The new matter objection is based on the limitation "the conductors having a pattern containing digital data representing locations of the good components, the defective component and the component contacts".

In regard to this limitation, please note page 13, line 22, to page 14, line 9, of the specification.

"Referring again to Figure 1, the redistribution layer 20 can be etched with the conductors 22 in patterns selected to achieve different objectives. As a first example, the redistribution layer 20 can be etched to repair or re-configure defective components 12D (Figures 4 and 5). Specifically, the initial testing step identifies the defective components 12D and *this information is contained in the digital data 36 (Figure 3)* supplied to the modulator 34. Some defects can be corrected by providing

conductors 22 that substitute redundant circuitry contained on the defective components 12D for defective circuitry.

Other defects can be corrected by configuring or re configuring the component 12D in a particular electrical format. For example, a memory component (e.g., DRAM) may be defective when configured as a 1 Meg X 16 device (i.e., 1 megabit deep by 16 bits wide = 16 megabits of total memory). However, the memory component may not be defective when configured as a 4 Meg X 4 device (i.e., 4 megabits deep by 4 bits wide = 16 megabits of total memory). *By electrically connecting, or alternately electrically isolating, selected component contacts 28 using the conductors 22 different configurations can be achieved.*" (italics added)

In view of the foregoing original disclosure, the new matter objection is submitted to be in error.

**3. 35 USC §112, second paragraph, rejections of claims 52, 56, 60 and 70 due to insufficient written description**

The 35 USC §112, second paragraph, rejections of claims 52, 56, 60 and 70 due to insufficient written description are submitted to be in error. With regard to these rejections the final Office Action states:

"In claims 52, 56, 60 and 70 the specification fails to describe the phrase "the conductors having a pattern containing digital data representing locations of the good components, the defective component and the component contacts".

As argued above, the specification supports the above limitation in the passage at page 13, line 22 to page 14, line 9 quoted in the previous section on new matter.

With regard to these rejections, the final Office Action further states:

"The final product of the invention clearly shows in Fig. 2J, Fig. 7, Fig. 7A, Fig. 7B and page 12, line 1-page 13, line 32 that the conductors 22p or 22 are just normal wiring circuits which are formed by etching the redistribution layer 30 according to the data received from the digital data 36."

Appellant disagrees that one skilled in the art would interpret the conductors 22p or 22 as just normal wiring circuits. Rather, the conductors have a physical structure that is different than conventional wiring on a semiconductor wafer. Specifically, the conductors have a unique pattern containing information in the form of digital data. This information allows the conductors to perform the function of redistributing the component contacts on the good component, and the additional function of either repairing, reconfiguring or electrical isolating component contacts on the defective components.

#### **4. 35 USC §112, second paragraph, rejections of claims 52, 56, 60 and 70 due to indefiniteness**

The 35 USC §112, second paragraph, rejections of claims 52, 56, 60 and 70 due to indefiniteness are submitted to be in error. With regard to these rejections the final Office Action states:

(a) Regarding the limitation "a plurality of conductors . . . in electrical communication with the component contacts configured to redistribute the component contacts on the good components" how is the plurality of conductors configured to redistribute the component contacts on the good components".

For an explanation, the specification and drawings of the application must be read and understood. Claims are to be read in light of the specification. In re Okuzawa, 537 F.2d 563, 190 USPQ 464 (CCPA 1976). In addition, only a person of ordinary skill in the art to which the invention pertains need be enabled by the application disclosure. In re Naquin, 158 USPQ 317 (CCPA 1968).

Accordingly, the present disclosure is directed to artisans of ordinary skill in semiconductor packaging. In this regard, redistribution conductors are well known to those skilled in the art of semiconductor manufacture.

As stated on page 10, lines 22-30 of the specification:

"In addition, the conductors 22 can be configured to locate or "fan out" terminal contacts (e.g., solder balls) for the components 12 in a desired pattern, such as a dense grid array. Redistribution layers are well known in the art of semiconductor manufacture for configuring different types of components."

From the above disclosure, one skilled in the art would know that the conductors 22 are configured to perform the stated redistribution function. However, as an additional function, the conductors 22 are configured to either repair, reconfigure or electrically isolate the defective components 12D contained on the substrate 10 (Figure 4).

With regard to the indefiniteness rejections, the final Office Action further states:

(b) Regarding the limitation "and to repair the defective component by connecting selected component contacts on the defective component," it is not clear how a defective component may be repaired by connecting the

defective component with other integrated circuits on the defective component. The limitation states that the component itself is defective, so how can it be repaired by connecting to itself?"

Applicant would respond that one skilled in the art of semiconductor manufacture would understand repair of a semiconductor component performed by connecting selected component contacts. The defective component is not being connected to itself as suggested by the examiner, but rather the component contacts on the defective component are being reconfigured to by pass defective circuitry and to substitute redundant circuitry. For example, one of the component contacts may be connected to a defective integrated circuit. This component contact could be bypassed by the conductors. Another component contact may be connected to a redundant integrated circuit. This component contact could be electrically connected to terminal contacts 64 (Figure 7B).

Also please note the description on page 13, line 33 to page 14, line 10 of the specification which states:

"Other defects can be corrected by configuring or re configuring the component 12D in a particular electrical format. . . . By electrically connecting, or alternately electrically isolating, *selected component contacts 28* using the conductors 22 different configurations can be achieved." (italics added)

As previously argued, claims are to be read in light of the specification and from the viewpoint of one skilled in the art. The skilled artisan in semiconductor manufacture is intelligent, and is familiar with technical disclosures. Accordingly, it is submitted that one skilled in the art would understand the stated configuration of the

conductors and the component contacts. Further, a claim can omit information that would be obvious to a person of ordinary skill in the art. In re Skriwan, 427 F.2d 804, 166 USPQ 85 (CCPA 1970).

With regard to the indefiniteness rejections, the final Office Action further states:

(c) Regarding the limitation "the conductor having a pattern containing digital data representing locations of the good components, the defective component and the component contacts," it is unclear how the pattern of a conductor contains digital data . . . when the conductor is nothing more than a metal wire and not software".

Appellant would respond that in formulating claims, an applicant may use either conventional terms, or may be his own lexicographer, as long as the meaning is clear. In re Cataing, 429 F.2d 461, 166 USPQ 550 (CCPA 1970).

In the present case, the pattern of conductors includes information in the form of digital data. It is the pattern of the conductors, and not the conductors themselves that contains the digital data. This information provides the conductors with a physical structure that performs the function of redistributing the component contacts, and of either reconfiguring or electrically isolating the component contacts on the defective components 12D. It is submitted that when read in light of the specification this meaning is clear, and that the metes and bounds of the claims can be ascertained.

#### **5. 35 USC §102(e) rejections of claims 52-62 and 70-77 over Hsuan et al.**

With respect to the rejections under 35 USC §102, each independent claim includes a different recitation, on the



configuration of the conductors. Accordingly, each independent claim is being argued separately.

Independent claim 52 and dependent claims 53-55

Independent claim 52 recites that the conductors are "configured to redistribute the component contacts on the good components and to repair the defective component by connecting selected component contacts on the defective component with selected integrated circuits on the defective component".

The feature of a pattern of conductors configured to perform the dual function of redistribution and repair is not disclosed or suggested by Hsuan et al. In addition, the feature of a pattern of conductors containing digital data representing the locations of the good component, the defective component and the component contacts is not disclosed or enabled by Hsuan et al.

Rather, in Hsuan et al. laser melting of fuses 118 (Figure 3) is used to repair inoperative memory cells. As stated at column 5, lines 54-60 of Hsuan et al.:

"Next, the fourth step 50 is a first repair process, in which each inoperative IC component found in the first testing process 40, if any, is disconnected from active use by using laser means to melt away the associated one of the first set of fuses 118. In the case of memory device, for example, the inoperative memory cell can be replaced by a backup one."

Admittedly, Hsuan et al. includes metallization layers 134a, 134b which function as a redistribution line structure (column 6, lines 11-19). However, this redistribution line structure is not configured to repair defective components, and does not have a pattern

containing digital data. In this regard, in Hsuan et al. the defective components are initially repaired, and then the redistribution line structure is formed in the packaging stage 12 (column 6, lines 11-19). A second repair process is then performed using "laser means to melt away the associated one of the second set of fuses 136" (column 6, lines 49-52).

The present component does not require fuses because it includes redistribution conductors which have "a pattern containing digital data representing locations of the good components, the defective component and the component contacts." In the final Office Action the above limitation is described as "functional or intended use language", which has been given no patentable significance. However, this interpretation is incorrect, as the pattern of the conductors is a physical characteristic which produces a novel and unobvious component.

Specifically, the present conductors include physical characteristics corresponding to digital data generated by testing of the components. For example, if the digital data indicates a component is defective, the pattern of the conductors includes some conductors that substitute redundant circuitry on the defective component. The presently claimed conductors are different than conventional repair conductors, such as the redistribution line structure in Hsuan et al., which includes fuses and no digital data. The fuses are an additional element, which make the component more complicated, and require an additional process step (e.g., blowing). In place of a set of fuses, the present conductors have a pattern containing digital data, which allows the conductors to perform repairs without the need for fuses.

Further, the conductors provide an improved product because fuses and interlevel conductors are not required to repair defective components. Both the unique structure of the conductors (e.g., the pattern containing digital data), and the improved results provided by the conductors (e.g., no blowing of fuses) make the claims novel and unobvious over Hsuan et al.

The final Office Action also states: "Since the term "digital data" is defined as the locations of the good components, the defective component and the component contacts and the patterned conductor of Hsuan et al. represents the locations of the good components, the defective component and the component contacts, the patterned conductor of Hsuan et al. contains the digital data. Thus Hsuan et al. meets the claim."

However, the intended definition for digital data is contained at page 12, lines 3-5 of the specification which states: "The digital data 36 represents a selected pattern that will be "written" or "laser imaged" on the radiant sensitive film 24."

The digital data is thus intended to refer to the selected pattern of the conductors. In Hsuan et al. the conductors have a pattern, but the pattern is standard (column 5, lines 40-43). In the present claims the digital data provides a customized or selected pattern for the conductors that fits the locations of the good components, the defective components and the component contacts. On the other hand, in Hsuan et al. the pattern of the conductors initially accommodates all of the components including the defective components. The fuses in Hsuan et al. don't change the pattern of the conductors, but rather make some of the conductors inoperative (i.e., defective

circuitry isolated by inoperative conductors) and other of the conductors operative (i.e., redundant circuitry connected by operative conductors). The conductors in Hsuan et al. thus do not have a unique pattern containing digital data, under the definitions provided by the present disclosure.

In view of the above limitations not being taught or suggested by Hsuan et al., claims 52-55 are submitted to be novel and unobvious over Hsuan et al.

Independent claim 56 and dependent claims 57-59

Independent claim 56 recites that the conductors are "configured to redistribute the component contacts on the good components and to electrically isolate the component contacts on the defective component". Admittedly, Hsuan et al. teaches electrical isolation of defective IC blocks (column 7, lines 19-23). However, the pattern of the conductors is not configured to achieve electrical isolation but rather is a standardized pattern. The fuses perform the function of electrical isolation by making some conductors inoperative, but with the pattern of the conductors remaining the same.

Further, claims 56-59 are submitted to be novel and unobvious over Hsuan et al. for essentially the same reasons argued with respect to claims 52-55.

Independent claim 60 and dependent claims 61-62

Independent claim 60 recites that the conductors are "configured to redistribute the component contacts on the good components and to reconfigure the component contacts on the defective component ". Applicant is unable to locate any teaching in Hsuan et al. of reconfiguring

component contacts on a defective component using a pattern of conductors containing digital data. In addition, there is no discussion in the final Office Action of this feature being anticipated by Hsuan et al.

Further, claims 56-59 are submitted to be novel and unobvious over Hsuan et al. for essentially the same reasons argued with respect to claims 52-55.

Independent claim 70 and dependent claims 71-77

Independent claim 70 recites that the conductors are "configured to redistribute the component contacts on the good components, and to either repair, reconfigure, or electrically isolate the defective component, or to electrically connect multiple good components in a cluster that excludes the defective component."

Claims 70-77 are submitted to be novel and unobvious over Hsuan et al. for essentially the same reasons argued with respect to claims 52-55.

## **viii. Claims appendix**

52. A semiconductor component comprising:

a substrate comprising a plurality of semiconductor components, each component including a plurality of component contacts and a plurality of integrated circuits in electrical communication with the component contacts, the components including a plurality of good components and at least one defective component; and

a plurality of conductors on the components in electrical communication with the component contacts configured to redistribute the component contacts on the good components and to repair the defective component by connecting selected component contacts on the defective component with selected integrated circuits on the defective component, the conductors having a pattern containing digital data representing locations of the good components, the defective component and the component contacts.

53. The component of claim 52 wherein the components include a second defective component and the conductors are configured to electrically isolate the second defective component.

54. The component of claim 52 wherein the components include a second defective component and the conductors are configured to reconfigure the component contacts on the second defective component.

55. The component of claim 52 wherein the components include a second defective component and the conductors are configured to electrically connect multiple components in a cluster that excludes the second defective component.

56. A semiconductor component comprising:  
a substrate comprising a plurality of components including a plurality of component contacts;  
the components including a plurality of good components and at least one defective component; and  
a plurality of conductors on the components configured to redistribute the component contacts on the good components and to electrically isolate the component contacts on the defective component, the conductors having a pattern containing digital data representing locations of the good components, the defective component and the component contacts.

57. The component of claim 56 further comprising a plurality of terminal contacts on the good components in electrical communication with the conductors and the component contacts on the good components.

58. The component of claim 56 wherein the conductors are configured to electrically connect a plurality of good components in a cluster that excludes the defective component.

59. The component of claim 56 wherein the substrate comprises a semiconductor wafer, and the components comprise semiconductor dice or semiconductor packages.

60. A semiconductor component comprising:

a substrate comprising a plurality of semiconductor components, each component comprising a plurality of integrated circuits and a plurality of component contacts in electrical communication with the integrated circuits, the components including a plurality of good components and at least one defective component; and

a plurality of conductors on the components having a pattern containing digital data representing locations of the good components, the defective component and the



component contacts, the conductors configured to redistribute the component contacts on the good components and to reconfigure the component contacts on the defective component.

61. The component of claim 60 further comprising a plurality of terminal contacts on the good components in electrical communication with the conductors and the component contacts on the good components.

62. The component of claim 60 wherein the substrate comprises a semiconductor wafer or portion thereof and the components comprise dice or packages.

70. A semiconductor component comprising:

a substrate comprising a plurality of semiconductor components including a plurality of good components and at least one defective component, each component comprising a plurality of component contacts and a plurality of integrated circuits in electrical communication with the component contacts; and

a metal redistribution layer on the substrate comprising a plurality of conductors having a pattern containing digital data representing locations of the good

components, the defective component and the component contacts, the conductors configured to redistribute the component contacts on the good components, and to either repair, reconfigure, or electrically isolate the defective component, or to electrically connect multiple good components in a cluster that excludes the defective component.

71. The component of claim 70 wherein the good components include a plurality of terminal contacts in electrical communication with the component contacts on the good components.

72. The component of claim 70 wherein the component contacts comprise bond pads.

73. The component of claim 70 wherein the conductors on the good components have a fan out configuration.

74. The component of claim 70 wherein the substrate comprises a semiconductor wafer.

75. The component of claim 70 further comprising a protective layer on the conductors on the good components.

76. The component of claim 70 wherein the components comprise semiconductor packages or dice.

77. The component of claim 70 wherein the components include a second defective component and the conductors are configured to repair, reconfigure or electrically isolate the second defective component.

#### **ix. Evidence appendix**

Included are copies of the evidence relied upon by the examiner as to the grounds of rejection under 35 USC §102 to be reviewed on appeal.

1. Hsuan et al. (US Patent No. 6,214,630 B1)

**x. Related proceedings appendix**

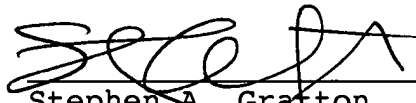
None.

**Conclusion**

In view of the foregoing arguments, Appellant submits the rejections of claims 52-62 and 70-77 are not proper. Appellant thus requests reversal of the rejections, and allowance of claims 52-62 and 70-77.

DATED this 2nd day of February, 2006.

Respectfully submitted:


  
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